Digital competences for smart learning during COVID-19 in higher education students from Spain and Latin America

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Abstract

Networked society before pandemic situation had become the context of a technology-supported environment for learning and teaching. Since COVID-19 pandemic occurred learning happened essentially mediated through connected smart devices that demand digital skills and reinforced Smart learning. This study aims to present a descriptive and comparative analysis focusing on digital competences in three different areas: Use, Learning and Critical thinking, justified in a global situation of intensive use of technology. Each area was analyzed considering the five subareas of digital competence: information management, communication, content creation, safety and problem solving. The study was designed under a non-experimental quantitative methodology in which higher education students from Spain, Colombia, Ecuador, and Mexico participated (N=926). Results show significant differences among countries that could help to improve not only formal education in Higher Education, but the digital skills needed for lifelong learning among citizenship in next future conditioned by recent global situation of pandemic.

Keywords

Digital competences; Smart education; Higher education; Learning; COVID-19; pandemic.

I. Introduction

Envisioned by Marshall McLuhan in the mid-20th century with his global village as a future perspective, the present Society of Knowledge greatly surpasses the expectations of a connected and participative world, compelled towards an unprecedented technological determinism (Ihlebæk, 2018). Together with this phenomenon, the digital transformation of the infrastructures clearly found in two areas: 1) network connections that are becoming more potent (5G, IoT, 4.0 Industry, smart cities, IA etc.) and more influential sources in our society, merging democracy and digitalization through IA development (Pedrero-Esteban & Pérez-Escoda, 2021) and 2) intelligent devices that are becoming more advanced: smartphones and wearables (Tripathi & Ahad, 2019) has been propelled by recent COVID-19 crisis. The network becomes the epicenter of the interaction and the functionalist paradigm of linear communication, organized into a hierarchy, and predetermined by a broadcaster and a receiver, has been transformed into an open, interconnected, decentralized, dynamic and flexible scheme (Buckingham, 2020). This change of communication scheme is re-informed and amplified by the effect of pandemic situation all around the world which provided education with a new and radical focus (Marinoni, Land and Jensen, 2020; Crawford et al., 2020) but with new challenges regarding fake news and disinformation, related with digital competences (Pérez-Escoda & Pedrero-Esteban, 2021). Recent facts have transformed the nature of the ruling paradigms, changing the roles of institutions, moreover the educational ones. As stated by OECD (2020), Covid-19 has accelerated our reliance on digital tools as enablers to continue learning while schools and universities has remained closed.

a. Born digital, nurture connected and obliged by the pandemic

As a product of the change in context, we find a juncture which deserves a more in-depth reflection: the exposure of the generations born after the year 2000 to technology in an unprecedent situation where stay connected seems to be the only option. This population have been sociologically conceptualized under different names: digital natives, digital generation, generation Z (Tapscott, 2008; Gardner & Davis, 2014) as a cohort that has grown immersed in tactile and connected technologies, collaborative and networked games, YouTube tutorials and social networks (Feijoo-Fernández, Sádaba, & Bugueño, 2020). Born in a technological context, the new generations have developed a sort of dependence and naturalization towards the digital (Gardner & Davis 2014).

This framework for new generations born digital and nurture connected has been intensified since the pandemic situation collapsed the world in March 2020 promoting distrust and information disorders (Pérez-Escoda, Pedrero-Esteban, Rubio & Jiménez, 2021). Despite the enormous consequences in economic, social, work and health areas it is worth noting the greater increase of Internet users all around the world. According to the last report from We are Social 2021, 1.3 million people joined any social network during the lockdown for Covid-19 which means a total of 4.3 million users for social networks globally speaking, an annual increase of 13%. The Internet penetrations corresponding to the countries analyzed is: 92% in Spain, 81% in Ecuador, 65% in Mexico and 63% in Colombia (Newman et al., 2021). In this line the Digital News Report from the Reuters Institute (Newman et al., 2021) highlight how the pandemic situation has also intensified the Internet use not only in entertainment areas (games, videos, music, sports, etc.) but in information consumption which introduces other specific problems such as fake news and misinformation requiring high levels of development in digital competences among citizens (Pérez-Escoda, García-Ruiz & Lena, 2021).

b. Digital competence and smart learning

The social and economic changes due the Covid-19 pandemic situation ratify the need for digital competencies that imply substantial and structural modification in their literacy (García-Ruiz & Pérez-Escoda, 2019). There are different approaches that describe digital competencies related with all the activities that an online environment offers us from different areas of action (García-Ruiz & Pérez-Escoda, 2021; Pettersson, 2018, Cabero, Romero, & Palacios, 2020; Redecker & Punie, 2017). Table 1 shows the areas used in this study and their definition.

Areas	Definition
Information and data literacy	Use technologies to access, find, organize, edit and manage digital information
Communication and collaboration	Identified as the ability to interact, communicate and collaborate through digital technologies and be able to participate in society and in participatory citizenship through public or private digital services
Digital content creation	Defined as the ability to create and edit digital content, to improve and integrate information and content into an existing body of knowledge while understanding how copyright and licenses are to be applied
Security	Related to the concepts of protection of devices personal data and health from the perspectives of use, learning and critical thinking
Problem solving	Skills related with the smart and creative use of digital tools in terms of needs, innovation, and identification of deficiencies.

Table 1. Areas of competencies and sub-competencies from digital competence. Source: Created from Redecker, & Punie (2017) and Carretero, Vourikari & Punie (2017).

Our study focuses not only on these competences but in levels of proficiency, applied in terms of use, learning and critical thinking outcomes as described below. According to literature from digital inequalities, the basic idea stems from a doble perspective: inequality from access and inequality from use (van Deursen, 2020). The study presented aims to analyse the inequality from use, analysing two different contexts: Spain and Latin American countries (Colombia, Mexico and Ecuador) in order to study possible inequalities in university students facing the COVID-19 situation. The differences between both frameworks remain in terms of well-beings shown in Figure 1, however all countries in sample were the most affected by COVID-19.

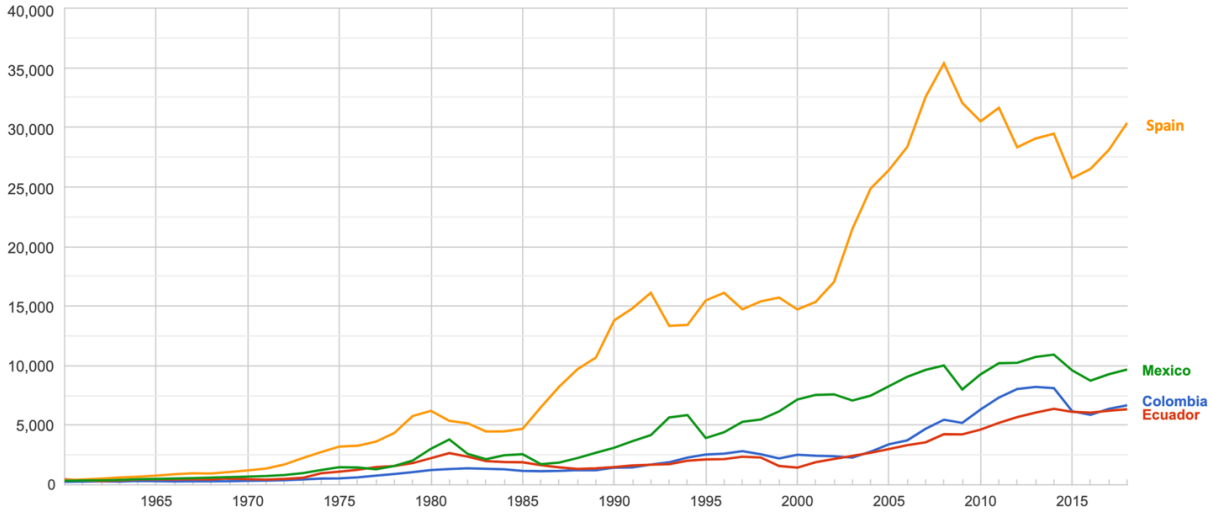

Figure. 1. GDP in countries studies. Source: World Bank, September 2020. Source: Google Public Data

Although a unanimous conceptualization of smart learning does not exist, there seems to be consensus in the fact that it is a type of learning where smart devices intervene and where digital competences remain essential. Smart learning or smart education, as expressed by Li, Tsang and Wong (2020) is more an educational paradigm of technology-enhanced learning emerging since the 2010s. Hwang and Choi described it as a "new 21st century educational paradigm that fosters and develops all students to become global leaders by renovating the existing education system, such as educational contents, methods, evaluations, and environments" (2016, p. 2). Learning during lockdown has been developed basically through smart devices in informal contexts, this is out of schools and universities (Crawford et al., 2020; Di Pietro et al., 2020; Dneprovskaya, Komleva & Urintsov, 2020). Covid-19 situation has globally exposed educational systems to equal necessities in terms of students subjected to a global lockdown only with technology mediating all kind of relations, education included.

According to this situation explained, the research proposed acquires special importance in the context of Latin countries: Spain and Latin America, where a smart learning definition and model is sought starting from evidence of the development of soft skills of the students in informal contexts that shelter the development of smart education (Chen, Cheng, & Chew, 2016; Bakken, Uskov, & Penumatsa, 2019), because, as pointed out by Hwang "new learning modes will raise new pedagogic issues" (2014, p. 11), even more since COVID-19 pandemic impose a global lockdown.

III. Research Methods

The methodological research design was quantitative and descriptive-comparative, as the intention is to describe the basic components of a specific phenomenon by extracting them from a given content through the process that is characterized by the rigor of their measurement. To collect the data, an instrument was created ad hoc, whose study variables were defined starting from the study of existing European proposals from Redecker & Punie (2017) and Carretero, Vuorikova and Punie (2017).

The result of this previous in depth study resulted in the design of an online questionnaire with a matrix of independent variables for the collection of sociodemographic data, and a matrix of 100 items groups in study constructs, with two dimensions of analysis: (a) a first one level with three areas of study that collected data on formal and informal environments; use, learning and

participation and (b) a second level, within each area where five digital competence subareas were studied as shown in Table 1. Using a Likert scale, the levels were determined as Never, Rarely, Often, and Always. This first questionnaire was submitted to expert judges who evaluated the pertinence and the clarity of all the items. As a result of this evaluation, 25 items were discarded, as they did not comply with the criteria established for pertinence and clarity. Figure 2 shows all areas and subareas addressed in the study.

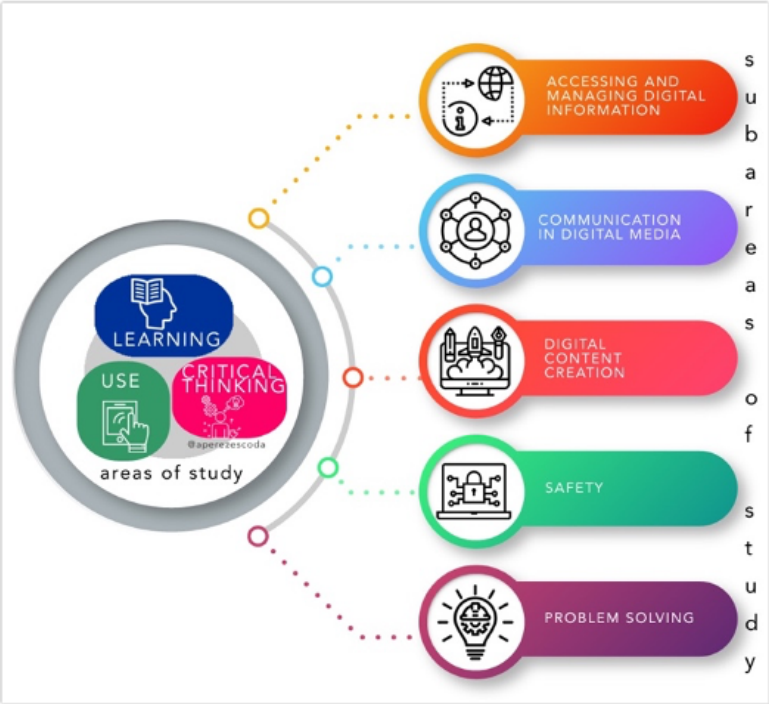

Figure. 2. Areas and subareas of study. Source: Own elaboration.

The statistical reliability of the instrument was analysed with Cronbach's alpha values for each area of study and country to guarantee the validity of the scale. In both cases, the internal consistency calculated resulted in values greater than 0.7, so the internal consistency of the instrument can be acceptable, as well its validity for the present study. An index of 0.79 was found for the area of Use, 0.8 for the area of Learning, and the 0.74 for the area of Critical thinking in the case of Spain, and 0.75 in the areas of "Use", 0.80 for the area of "Learning", and 0.82 in the area of "Critical thinking" in the case of Latin America. Data coding was established as can be seen in Table 0 (https://doi.org/10.6084/m9.figshare.11881449).

A convenience sampling was utilized to guarantee the high number of responses, with the sample composed by university students aged 17 to 30 (N=969) belonging to Spain (N=253) and Latin America (N=716). These students were enrolled at eight different universities in four different countries: Colombia, Ecuador, Mexico and Spain. The description of the sample according to country, gender and age is shown in Table 2.

		Colombia N=228 (23.5%)	Ecuador N=258 (26,6%)	Mexico N=230 (23.7%)	Latin America N=716 (73.9%)	Spain N=253 (26.1)	Total N=969
Gender	Male	184 (80.7 %)	193 (74.8 %)	146 (63.5%)	523 (72.9%)	204 (80.6 %)	727 (75.0 %)
	Female	44 (19.3 %)	65 (25.2 %)	84 (36.5%)	193 (27.1%)	49 (19.4 %)	242 (25.0 %)
Age	17-24	197 (86.4 %)	242 (93.8 %)	203 (88.3%)	642 (89.5%)	148 (58.5 %)	790 (81.5 %)
	25-30	26 (11.4 %)	13 (5.0%)	24 (10.4%)	63 (8.8%)	57 (22.5 %)	120 (12.4 %)
	+30	5 (2.2%)	3 (1.2%)	3 (1.2%)	11 (1.5%)	48 (29.0 %)	59 (6.1%)

Table 2. Description of the sample according to age and gender. Source: Own elaboration.

It should be highlighted that despite the samples in both contexts not being the same in number, the comparison between them, it could make sense as it is a comparison of the difference in means between the two independent groups of sufficiently large sizes.

IV. Results and data analysis

Results were obtained with the software program SPSS version 25, as for the basic statistical descriptions (means and standard deviations). The Mann-Whitney U test was utilized for the study of significant differences between the samples of two groups, as it is considered to be one of the most useful for working with non-parametric data (Nachar, 2008). To estimate the results, the effect size was evaluated according to the η^2 value, with the small effect considered for values that exceed η^2=0.01 and a moderate effect for those that exceeded η^2=0.39 (Cohen 1988). Both statistical tests were studied on the three constructs: Use, Learning and Critical thinking analyzed in a total of 75 items (25 for each of the three constructs). Results are presented according to all five subareas determined in the three areas stablished: Use, Learning and Critical thinking as shown in Figure 2 and only the item where significant differences and observable effect size were found, are shown.

a. Accessing and Managing Digital Information

Statistically significant differences were found, as shown in Table 3, in the "Use habits for searching videos in YouTube" between the Spanish sample and the Latin American one, with its frequency being greater in the second population (U=79769.00, p<0.000, η^2=0.017). The Latin American sample utilized YouTube more frequently for searching for videos. This was also the case for saving information found on the Internet, with more frequent results in Latin America (U=77375.00, p<0.000, η^2=0.014).

Areas of study	Items presenting significant differences		Mean	SD	Mean Rank	Mann-Whitney U	Asym. Sig. (2 –	η^2
EVERYDAY USE	Item 1(4Ua): I search for videos on YouTube	SP*	3.39	0.611	430.43			
		AM**	3.56	0.585	504.28			
		Total	3.51	0.596		76769.00	0.000	0.017
	Item 2 (5Ua): I store the information I find on the Internet so I can use when I need it	SP*	2.84	0.750	432.83			
		AM**	3.05	0.793	503.43			
		Total	3.00	0.787		77375.00	0.000	0.014
LEARNING	Item 3 (4La): I edit information on Wikipedia about subjects I know about	SP*	1.34	0.670	390.65			
		AM**	1.77	0.903	518.34			
		Total	1.66	0.868		66703.00	0.000	0.050
	Item 4 (5La): I search for information in videos to understand some subjects better	SP*	2.70	0.663	400.75			
		AM**	3.02	0.728	514.77			
		Total	2.94	0.725		69257.50	0.000	0.039
CRITICAL THINKING	Item 5 (2Ca): The Internet allows me to stay current on the news or events which other media would not allow me to be familiar with	SP*	3.34	0.595	544.06			
		AM**	3.12	0.687	464.13			
		Total	3.18	0.671		75631.50	0.000	0.019

* (SP) Spanish sample N=253 ** (AM) Latin American sample (Colombia, Ecuador and Mexico) N=716
Note. *p < .05.

Table 3. Accessing and Managing Digital Information. Source: Own elaboration

If the response distribution figures are observed for each of the items, Figure 3, it is confirmed how the differences between both samples are evident.

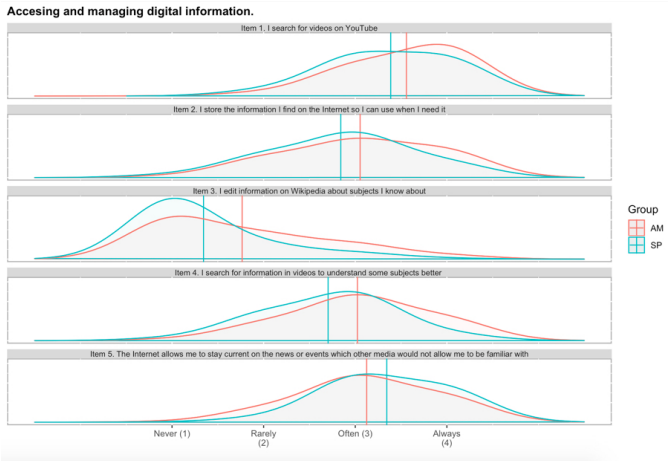

Figure 3. Distribution of the items with statistically significant differences and with a noticeable effect size in the area of access and management of digital information. Source: Own elaboration

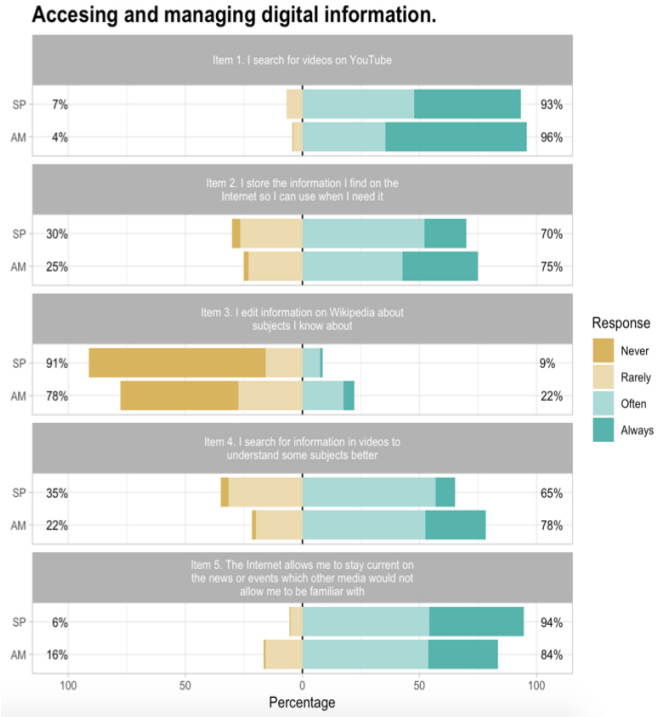

Figure 4. Graphical representation of the percentages of the response according to items with statistically significant differences and noticeable effect size. Source: Own elaboration

The percentages of response in both contexts in the case of the items 1, 2, 4 and 5, indicate that most of the sample usually or always performs the activities planned, with more frequent significant differences in the Latin American context for the area "Use" item "Saving information for using it when needed" (M1=2.84 SD=0.75 M2=3.05 SD=0.79 U=77375.0 P<0.000 η^2=0.014) and also for the area of "Critical thinking" (M1=2.70 SD=0.66 M2=3.02 SD=0.73 U=69257.5 P<0.000 η^2=0.039).

b. Communication in Digital media

As for the second subarea of study statistically significant differences (p<0.05) and noticeable effect size were found in eight different items as shown in Table 4.

Areas of study	Items presenting significant differences		Mean	SD	Mean Rank	Sig.(2 – Tailed)	η^2
USE	Item 1 (6Uc): I quickly answer any message I receive	SP*	2.94	0.670	528.48		
		AM**	2.78	0.737	469.64		
		Total	2.82	0.723		.002	.010
	Item 2 (10Uc): I prefer to communicate with others through the internet than in person	SP*	1.68	0.705	379.75		
		AM**	2.11	0.817	522.19		
		Total	1.99	0.811		.000	.058
	Item 3 (6Lc): I communicate through the Internet to doing collaborative work with my classmates	SP*	2.92	0.829	399.35		
		AM**	3.28	0.668	515.26		
		Total	3.19	0.731		.000	.039

LEARNING	Item 4 (7Lc): Communicating through the Networks helps me learn	SP*	2.71	0.750	436.72		
		AM**	2.91	0.734	502.06		
		Total	2.85	0.743		.000	.013
	Item 5 (9Lc): We help each other with the works and exams with WhatsApp or another chat application	SP*	3.16	0.868	579.33		
		AM**	2.72	0.951	451.61		
		Total	2.83	0.950		.000	.045
	Item 6 (10Lc): I use platforms such as Moodle or blogs to communicate with my professors	SP*	2.81	0.913	620.96		
		AM**	2.14	0.944	436.96		
		Total	2.31	0.982		.000	.090
CRITICAL THINKING	Item 7 (9Cc): I have reported a situation of cyberbullying	SP*	1.33	0.723	390.92		
		AM**	1.82	1.040	518.24		
		Total	1.69	0.991		.000	.052
	Item 8 (10Cc): I disseminate every I receive through the networks	SP*	1.51	0.561	431.59		
		AM**	1.76	0.803	503.87		
		Total	1.70	0.755		.000	.015

* (SP) Spanish sample N=253 ** (AM) Latin American sample (Colombia, Ecuador and Mexico) N=716
Note. p < .05.

Table 4. Communication in Digital Media. Source: Own elaboration

Data let us observe that the Spanish sample is more proactive to quickly answering every type of digital message, as shown by the comparative analysis (U=79573.00, p<0.002, η^2=0.010). As for a mean of 2.78 in Latin American sample, a value of 2.94 was found in the Spanish sample

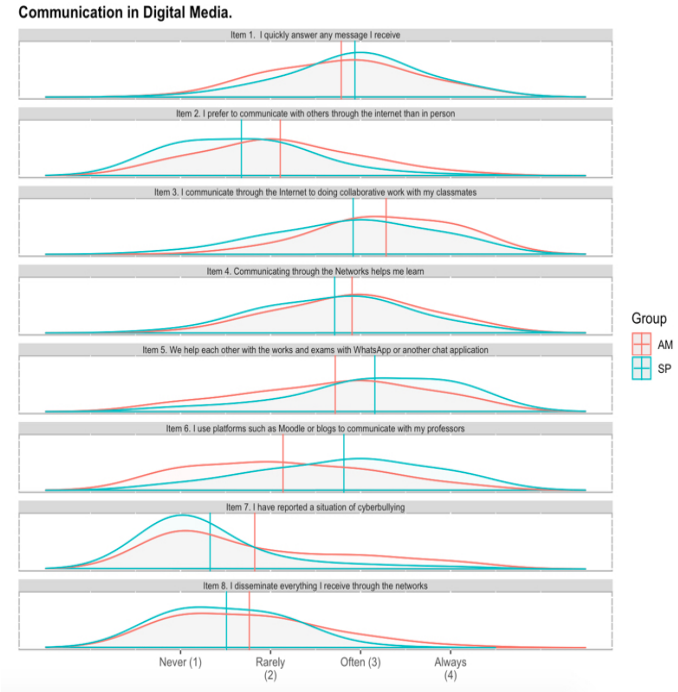

Figure 5. Distribution figures of the items with statistically significant differences and noticeable effect size in the area of Communication in digital media.Source: Own elaboration

This trend is re-enforced if we take into account the results of the item "We help each other with the work and exams through WhatsApp or other chats", where an important difference was found between both samples (U=66709.00, p<0.000, η^2=0.045) as more clearly shown in Figure 5 and Figure 6. For a mean of 2.72 for the Latin American countries, a value of 3.16 was found for Spain. The communication with the teachers was more intense for the Spanish sample, 2.81, as compared to 2.14 (U=66709.00, p<0.000, η^2=0.090).

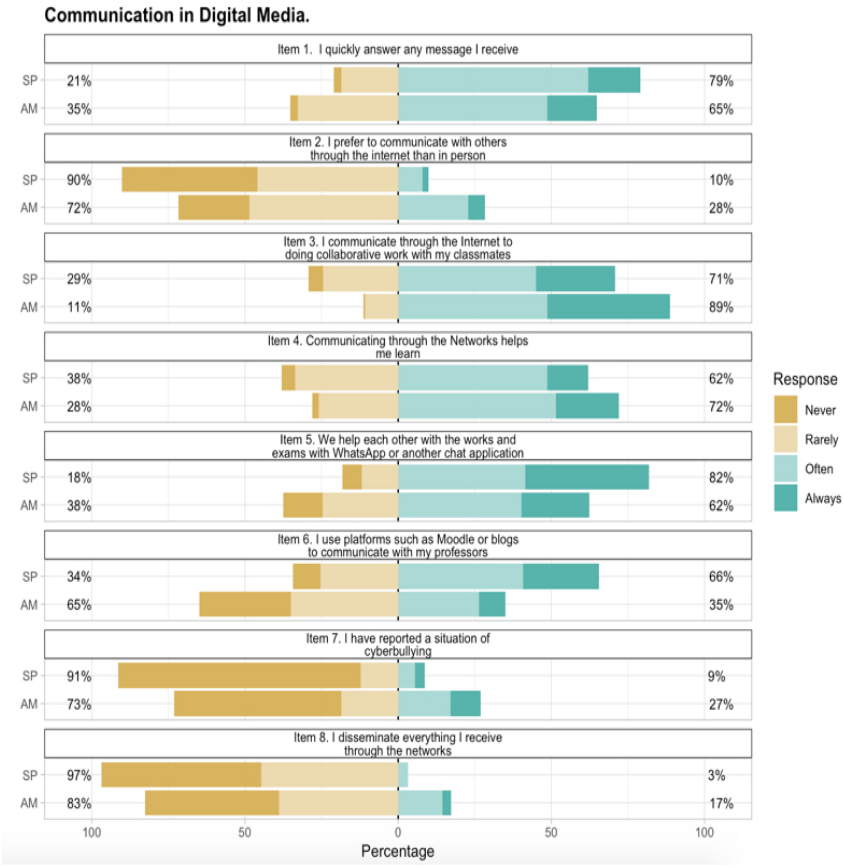

Figure 6. Graphical representation of the response percentages according to items with statistically significant differences and noticeable effect size in the area of Communication in digital media. Source: Own elaboration

c. Digital content creation

The results when speaking about a participative culture that is characterized by the emergence of a citizen who naturally creates and shares content through connected devices, show many significant differences in the items studies, as shown in Table 5.

Areas of study	Items presenting significant differences		Mean	SD	Mean Rank	Sig. (2 – Tailed)	η^2
USE	Item 1 (12Ud): I configure my profile in the social networks so that it is private	SP*	3.49	0.824	529.65		
		AM**	3.31	0.880	469.22		
		Total	3.36	0.869		.001	.011
	Item 2 (14Ud): I accept invitations from unknown people	SP*	1.36	0.586	437.47		
		AM**	1.56	0.745	501.79		

		Total	1.51	0.712		.000	.014
	Item 3 (15Ud): I cover my webcam when I don't use it	SP*	3.04	1.289	580.79		
		AM**	2.40	1.280	451.15		
		Total	2.57	1.313		.000	.046
LEARNING	Item 4(12Ld): The work I share on the Internet with my classmates can be copied by others	SP*	1.92	0.849	407.21		
		AM**	2.27	0.880	512.49		
		Total	2.18	0.885		.000	.030
	Item 5 (13Ld): I share my passwords of the tools or sites I use for doing the work for the courses with my classmates	SP*	1.53	0.833	434.31		
		AM**	1.75	0,.895	502.91		
		Total	1.70	0.884		.000	.014
CRITICAL THINKING	Item 6 (13Cd): I can delete the content I shared on the Internet without leaving a trace	SP*	1.81	0.858	398.95		
		AM**	2.21	0.939	515.41		
		Total	2.10	0.935		.000	.037
	Item 7 (14Cd): Participating in networks makes it easy for others to use my data without permission	SP*	2.88	0.920	548.33		
		AM**	2.57	0.989	462.62		
		Total	2.65	0.981		.000	.020
	Item 8 (15Cd): I configure all my profiles so that they are private	SP*	3.49	0.795	536.93		
		AM**	3.25	0.910	466.65		
		Total	3.31	0.887		.000	.015

* (SP) Spanish sample N=253 ** (AM) Latin American sample (Colombia, Ecuador and Mexico) N=716
Note. $p < .05$.

Table 5. Digital Content Creation. Source: Own elaboration

In the area of "Use", statistically significant differences are found in "Configuration of social networks profiles" with the frequency being higher in the case of the Spanish sample ($U=79277.00$, $p<0.000$, $\eta^2=0.011$), which denotes a greater suspicion about their privacy. This trend is confirmed in the case of covering the webcam on their laptops, a gesture that is also more disseminated among the sample in Spain ($U=66340$, $p<0.000$, $\eta^2=0.046$). The attitude shown in the area of "Use" is also re-enforced in the items that show significant differences in the case of the area of "Learning", where the item "Sharing works online" ($U=70893.00$, $p<0.000$, $\eta^2=0.030$) and "Sharing passwords with colleagues" ($U=77748.00$, $p<0.000$, $\eta^2=0.014$) is more commonly done among Latin American sample than in the case of Spanish university students.

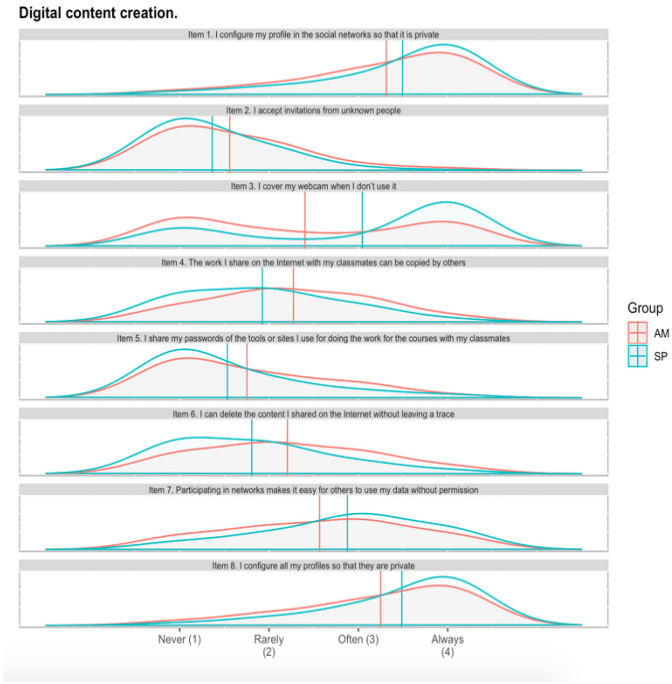

Figure 7. Distribution figures of the items with statistically significant differences and noticeable effect size in the area of content creation. Source: Own elaboration

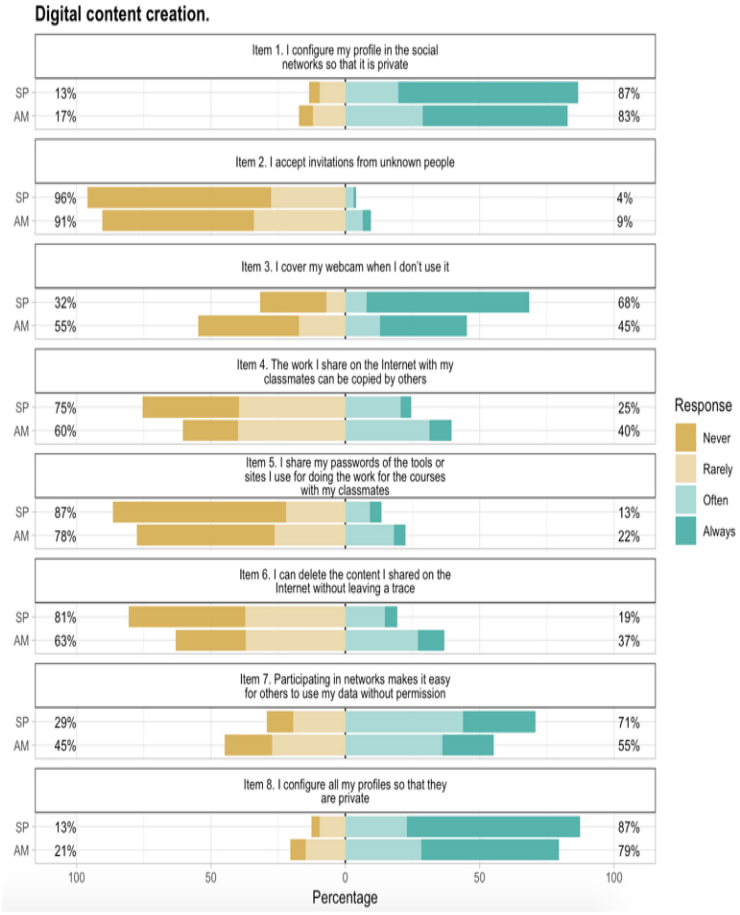

Figure 8. Distribution figures of the items with statistically significant differences and noticeable effect size in the area of content creation. Source: Own elaboration

Figures 7 and 8 visually show the significant differences, but also the trends in both samples whose behavior in the case of "Critical thinking" reveals important differences. In the case of "Deleting content on the Internet without leaving a trace", the Latin American sample shows a very different behavior with a percentage of 19% of individuals who confirm doing it often or always as compared to 37% of the Spanish sample (M1=1.81 SD=0.85 M2=2.21 SD=0.93 U=68803.0 P<0.000 η^2=0.037). Likewise, the Spanish sample shows to have a more important perception in the item "Participating in networks facilitates that other use my data without permission" with a percentage of 77%, as compared to 55% in the case of the Latin American sample (M1=2.88 SD=0.92 M2=2.57 SD=0.98 U=74552.0 P<0.000 η^2=0.020).

d. Safety

One of the competences that generates the most debate considering bad practices, abuses and negative habits is related with "Safety" subarea. This area revealed significant differences in both geographic areas in nine items as shown in Table 6.

Areas of study	Items presenting significant differences		Mean	SD	Mean Rank	Sig. (2 – Tailed)	η^2
USE	Item 1 (18Us): Using the Internet helps me solve problems that I would not be able to solve through other means	SP*	2.87	0.587	545.15		
		AM**	2.65	0.743	463.75		
		Total	2.71	0.712		.000	.020
LEARNING	Item 2 (17Ls): I use Google Drive to work with my classmates	SP*	2.68	1.007	534.15		
		AM**	2.43	0.987	467.63		
		Total	2.49	0.998		.001	.012
	Item 3 (19Ls): The social networks help me with my studies	SP*	2.32	0.763	398.87		
		AM**	2.68	0.834	515.43		
		Total	2.58	0.831		.000	.038
	Item 4 (20Ls): I learn more on the Internet than in class	SP*	2.02	0.702	432.86		
		AM**	2.25	0.807	503.42		
		Total	2.19	0.787		.000	.015
CRITICAL THINKING	Item 5 (16Cs): Knowing the Internet works in depth will help me find work in the future	SP*	3.13	0.641	537.25		
		AM**	2.91	0.781	466.54		
		Total	2.97	0.753		.000	.015
	Item 6 (17Cs): I use the Networks to help people who have problems	SP*	2.16	0.728	418.77		
		AM**	2.43	0.817	508.4		
		Total	2.36	0.804		.000	.023
	Item 7 (18Cs): I try to behave correctly and respectfully in the Networks	SP*	3.65	0.568	567.07		
		AM**	3.35	0.722	456		
		Total	3.43	0.708		.000	.038
	Item 8 (19Cs): I use the same	SP*	3.59	0.574	537.56		

	values of respect on the Internet as I do in real life	AM**	3.37	0.742	466.43		
		Total	3.02	0.874		.000	.016
	Item 9 (20Cs): I monitor everything there is on the Internet about me to have a good reputation online	SP*	2.77	0.940	415.34		
		AM**	3.11	0.832	509.61		
		Total	2.73	0.846		.000	.025

* (SP) Spanish sample N=253 ** (AM) Latin American sample (Colombia, Ecuador and Mexico) N=716
Note. p < .05.

Table 6. Digital Content Creation. Source: Own elaboration

The greatest significant differences between both contexts are reflected in the area of "Critical thinking", where significant differences are found in all items with medium effects in the η^2 value where the effect size is maintained between 0.04 and 0.11. In the item "I try to have an adequate and respectful behavior in the networks", an important difference is observed in the behavior of the students, which highlights 13% in the case of Latin America and 3% in the case of Spain, who rarely or never behave in networks or is respectful (M1=3.65 SD=0.56 M2=3.35 SD=0.72 U=69809.50 P<0.000 η^2=0.038). On the other hand, the digital reality seems to be placed more on the preoccupation of Latin American students analyzed (M=3.11 SD=0.83) that in the Spanish ones (M=2.77 SD=0.94) with a statistically significant difference (U=72950.00 η^2=0.025).

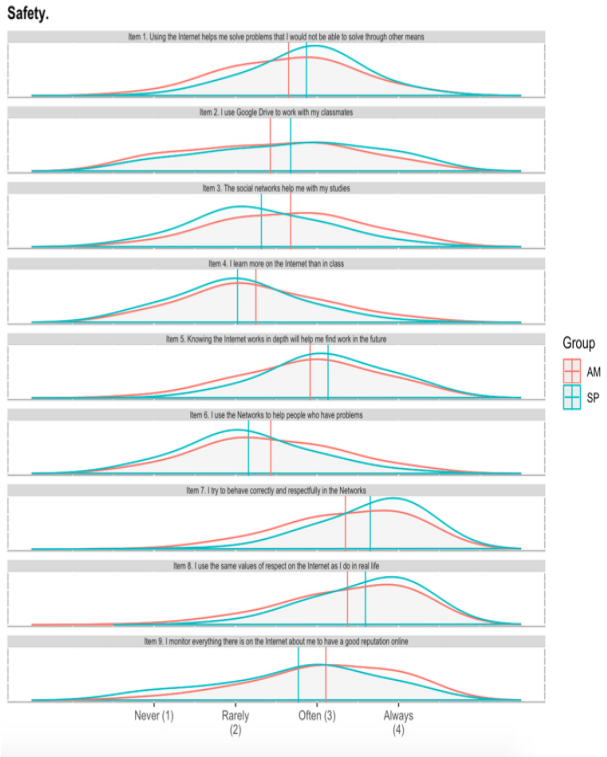

Figure 9. Distribution figures of the items with statistically significant differences and noticeable effect size in the area of safety.Source: Own elaboration

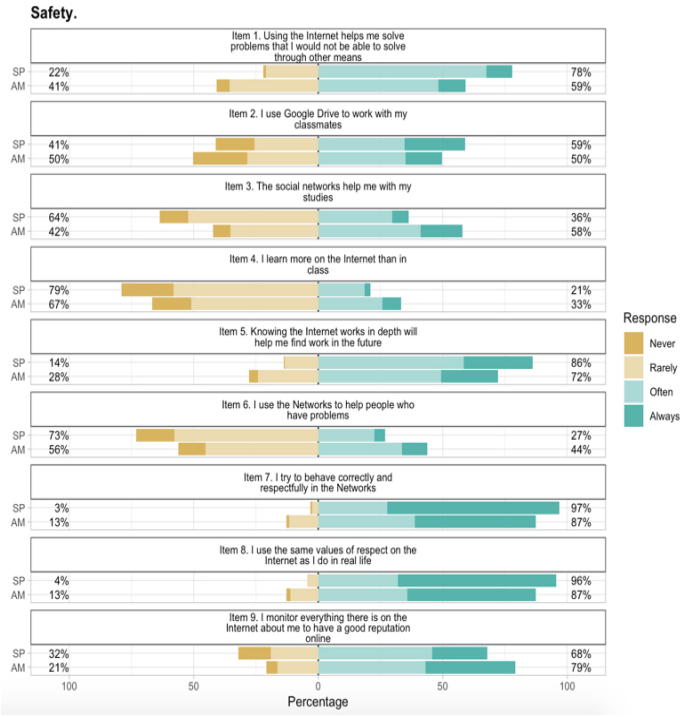

Figure 10. Graphical representation of the response percentages according to items with statistically significant differences and noticeable effect size in the area of safety. Source: Own elaboration

Significant differences in the area of "Learning" are shown in Figures 9 and 10. The Latin American students seem to learn more from the internet that the Spanish ones, despite neither of the two samples declare to learn more from the Internet than in the classroom (M1=2.05 SD=0.70 M2=2.25 SD=0.80 U=77383.50 P<0.000 η^2=0.015). If seems evident that in Latin America, the social networks help the students more in their learning process than in the case of the Spanish sample (M1=2.32 SD=0.76 M2=2.68 SD=0.83 U=68784.00 P<0.000 η^2=0.038), where a third part of the students very often or always learn from the social networks.

e. Problem solving

The last sub-area analyzed is the area where both samples showed fewer significant differences. As shown on Table 7, only two items had a different behavior.

Areas of study	Items presenting significant differences		Mean	SD	Mean Rank	Sig. (2 – Tailed)	η^2
LEARNING	Item 1 (22Lp): I record videos and edit them for class work	SP*	2,06	0,770	417,13		
		AM**	2,36	0,898	508,98		
		Total	2,28	0,876		.000	.023
	Item 2 (23Lp): I share my own contents on the Internet so that others can learn	SP*	1,68	0,704	431,61		
		AM**	1,96	0,920	503,87		
		Total	1,88	0,877		.000	.015

* (SP) Spanish sample N=253 ** (AM) Latin American sample (Colombia, Ecuador and Mexico) N=716
Note. p < .05.

Table 7. Digital Content Creation. Source: Own elaboration

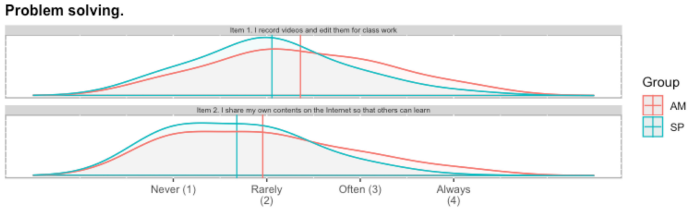

Figure 11. Distribution figures of the items with statistically significant differences and noticeable effect size in the area of problem solving. Source: Own elaboration

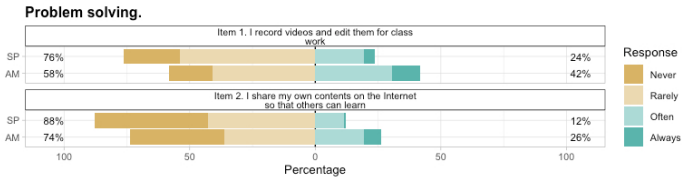

Figure 12. Graphical representation of the response percentages according to items with statistically significant differences and noticeable effect size in the area of problem solving. Source: Own elaboration

In the case of item "Creatively using digital tools for recording and editing videos for work in the classroom" (M1=2.06 SD=0.77 M2=2.36 SD=0.89 U=73404.00 P<0.000 η^2=0.023) as well as "Sharing self-created content on the Internet so that others learn" (M1=1.68 SD=0.70 M2=1.96 SD=0.92 U=77066.00 P<0.000 η^2=0.015), the Latin American students had a more proactive attitude, with 42%, as compared to 24% in case of the Spanish students, almost double for the first item, and more than double for the second item, with 26% of the Latin American students as compared to 12% of the Spanish ones.

V. Discussion and conclusions

The development of smart learning has reached during pandemic situation a milestone with all students using smart devices for learning in informal environments, becoming a growing trend in education and highlighting its relevance as pointed in previous studies (Dneprovskaya, Komleva, & Urintsov 2020; Wang & Nunes 2019; Zhu, Sun, & Riezebos 2016). Moreover, digital competences, that have been, since their endorsement, and essential training issue, studied from different perspectives: creative and informal (Taddeo & Tirocci 2019; Masanet, Guerrero-Pico, & Establés 2019), in the initial training of preservice teachers (Girón-Escudero, Cózar-Gutiérrez, & González-Calero 2019; Güneş & Bahçivan 2018; Silva, Usart, & Lázaro-Cantabrana 2019) and in the training of university teachers (Blau and Shamir-Inbal 2017; Instefjord & Munthe, 2016) are remarked as an inherent element to the training needed in the society of information. This article offers a new approach, considering the intensive exposure of population to digital devices during pandemic situation, specifically during global lockdown. In this regard, to the traditional study of digital competences in the five areas (Redecker & Punnie, 2017) this research adds contextual areas of study regarding Use, Learning and Critical Thinking. It supposes a new and deeper perspective to the traditional focused on learning contexts (Blau & Shamir-Inbal, 2017).

As made evident in previous studies in the academic environment of the digital competencies and their development (Iordache, Mariën, and Baelden 2017; From 2017; Feijoo-Fernández, Sádaba, & Bugueño, 2020) or international reports (ITU 2018), their evaluation or measurement is a complex task that requires technical mechanisms that are continuously updated. However, the

measurement of these new competencies, liked to the recognition of new learning spaces mediated by connected smart devices (Che, Cheng, and Chew 2016; Zhu, Yu, and Riezebos 2016) offer a more adequate view, alongside rationale that are closer to the current real-world use of technology by the younger population. The comparative view of the work conducted allows for a two-sided lecture: the first, based on the fact that, as highlighted in the indicators of digital economy set out by the OCDE (2018) and in line with those of the ITU (2018), the digital skills are the cornerstone for a society's progress, based on the training and skills of the population, and in second place, that the digital competencies are a guarantee of an efficient universal access towards a changing education that promotes new competencies but demands new necessities.

The work presented is found in line with the last report by the OECD (2020) that constitutes part of the OECD Learning Framework 2030, because, although the analysis of the data has been focused on the analysis of significant differences between the samples, the great quantity of even results should be noted, despite the analysis being conducted on samples from different countries. In agreement with tenets of Smart Learning, focused on the learning of the student, obtaining maximum performance of the formative, formal and informal itineraries (Zhu, Yu, and Riezebos 2016), it can be concluded, with the results obtained, that the main differences between the countries are precisely centered in the two areas: "Learning", where a total of 13 items with significant differences were found; and "Critical Thinking" with 10 items presenting differences. "Use" seemed to be the area with fewer significant differences only 6 items from the 75 studied.

Having in mind the limitations of the work presented, it can be stated that it is a novel contribution that makes evident not only that the study of the digital competencies remain an important issue to be developed and studied in higher education but the necessity to amplify it in a contextual framework, regarding not only "Learning" but "Use" and "Critical thinking". It is therefore confirmed that the use of technology has been globalized, however, their efficient use for learning has yet to be treated in depth in education policies and national actions that can guarantee the real exploitation of technology for the training of participatory, democratic citizens with ecological values, and which is related, without a doubt, with the training not only of the students, but of the professors who are currently actively teaching.

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